

Basics of Entomology

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Entomology

Entomology is the study of insects

- There are more than 100,000 different species of insects in North America.
- In the typical yard there can be a 1,000+ insects at any given time

The Role of Insects

- Pollinate food crops, fruits and vegetables
- Provide food for birds, fish and humans
- Produce useful products like honey, wax, silk and shellac

Negative Impact

While only 3% of insects are labeled “pests” the negative impact on humans is significant.

- Crop Damage (both plant and animal)
- Defoliate
- Shade loss/ destruction
- Transmit disease

Classification of Insects

- Insects are classified using binomial nomenclature, a 2-word naming system used to classify organisms.
- This scientific name consists of a genus and species.
- Scientific names can be written in italics, first word capitalized, second in lowercase and can be underlined and abbreviated.

Scientific Names

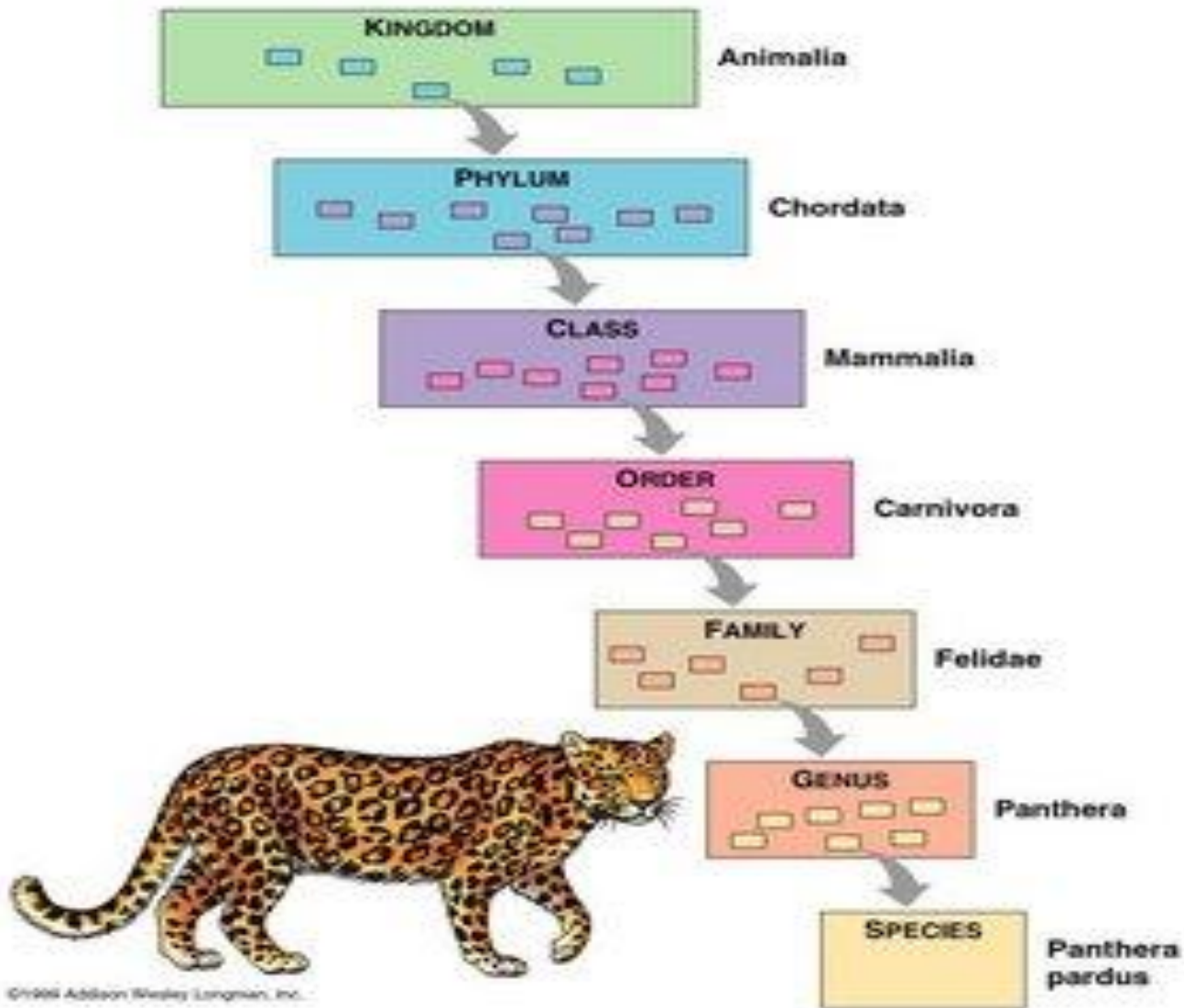
Example: Red Oak

Can be written

- *Quercus rubra*
- *Q. rubra*
- *Quercus rubra*
- *Q. rubra*



Classification Hierarchy



Animal Kingdom

The Animal Kingdom has many divisions, phyla, that contain agricultural pests:

- Arthropoda (insects, spiders, crayfish, millipedes)
- Aschelminthes (roundworms, trichina)
- Platyhelminthes (flatworms, flukes, tapeworms)
- Mollusca (snails, slugs, clams)

Arthropoda



Aschelminthes (Round Worms)



Platyhelminthes (Flatworms)



Mollusca (Mollusks)



Insects

- Insects are in the phylum Arthropoda.
- Arthropods are extremely important groups of animals, representing $\frac{3}{4}$ of the known species that exist.

Classes of the Phylum Arthropoda

Table 6-1

Contains the following information:

- Classes
- Examples
- Body Segments
- Pairs of Legs
- Agricultural Importance

Orders of the Class Insecta

Table 6-2

Contains the following information:

- Order
- Common Name
- Metamorphosis (note- complete & incomplete)
- Mouthparts
- Wings

Insect Form & Structure

pg. 3

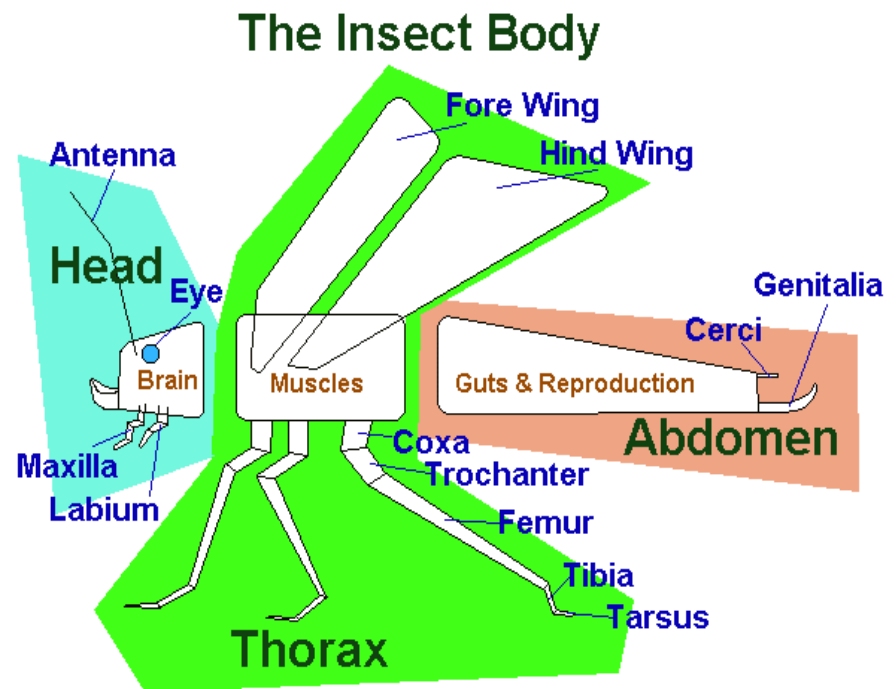
All adult members of the class Insecta possess

- 3 body regions (segmented)
- 3 pairs of legs (often modified to suit the environment)
- 1 pair of antennae
- 0-2 pairs of wings

Insect Body

The body of an insect has 3 distinct body regions (Fig. 6-1)

- Head
- Thorax
- Abdomen



Body Covering

An insect's body is not supported by a bony skeleton but a tough body wall or exoskeleton.

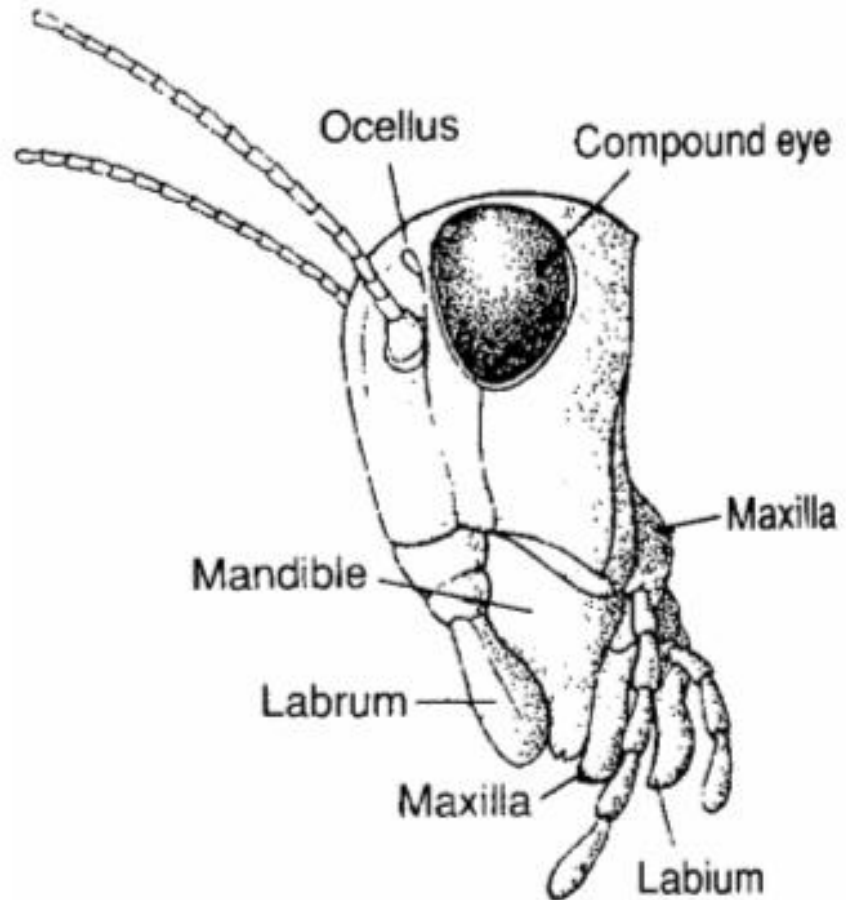
The exoskeleton contains a cuticle-like layer of wax that determines permeability or drying.

The cuticle contains segments, sutures, or plates, that allow flexibility.

Head

An insect head contains:

- Eyes (simple (ocellus) & compound)
- Mouth Parts
- Antenna



Thorax

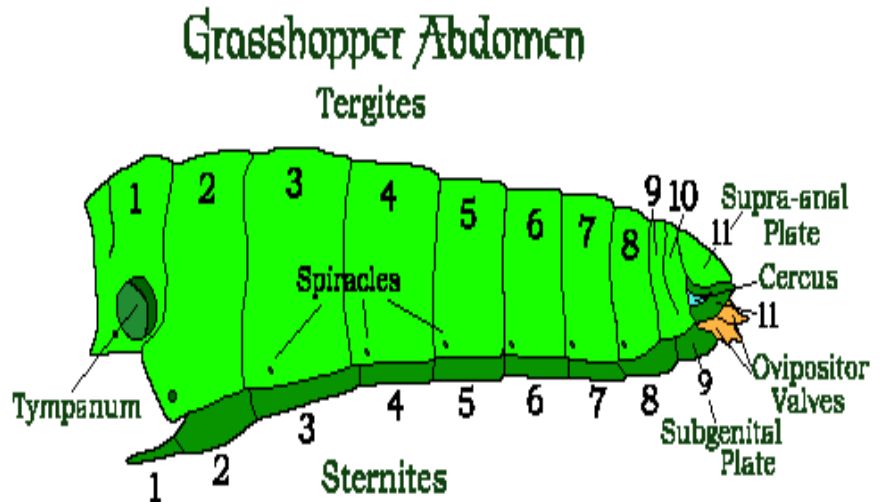
An insect thorax:

- Point of attachment for legs and wings
- Most of the insect muscles

Abdomen

An insect abdomen:

- 11-12 segments (often hard to distinguish)
- Reproductive organs
- Modified appendages for egg laying
- Spiracles



Eyes

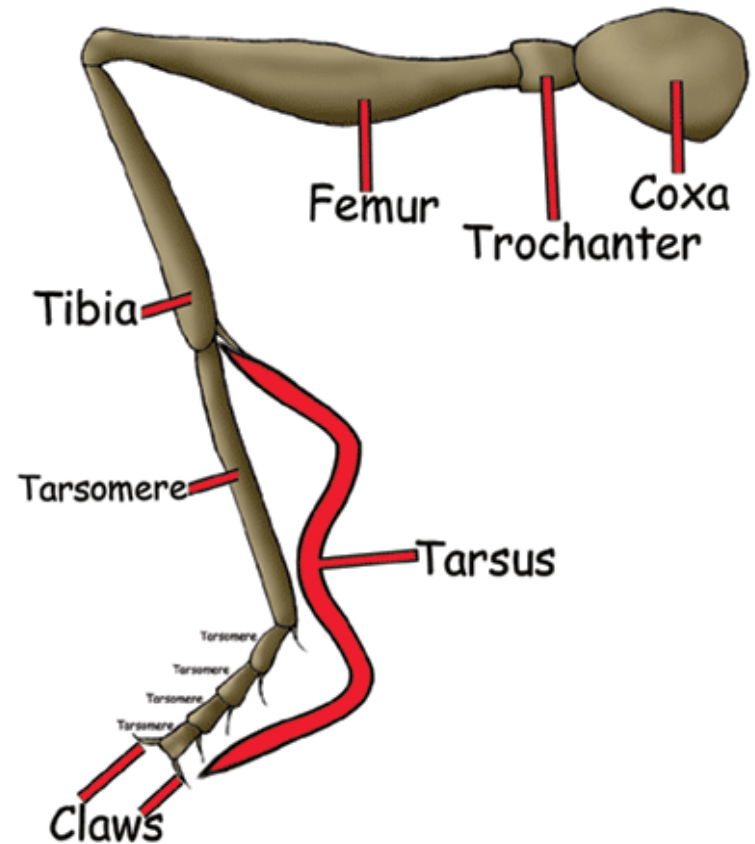
Eyes can be

- Compound
- Simple

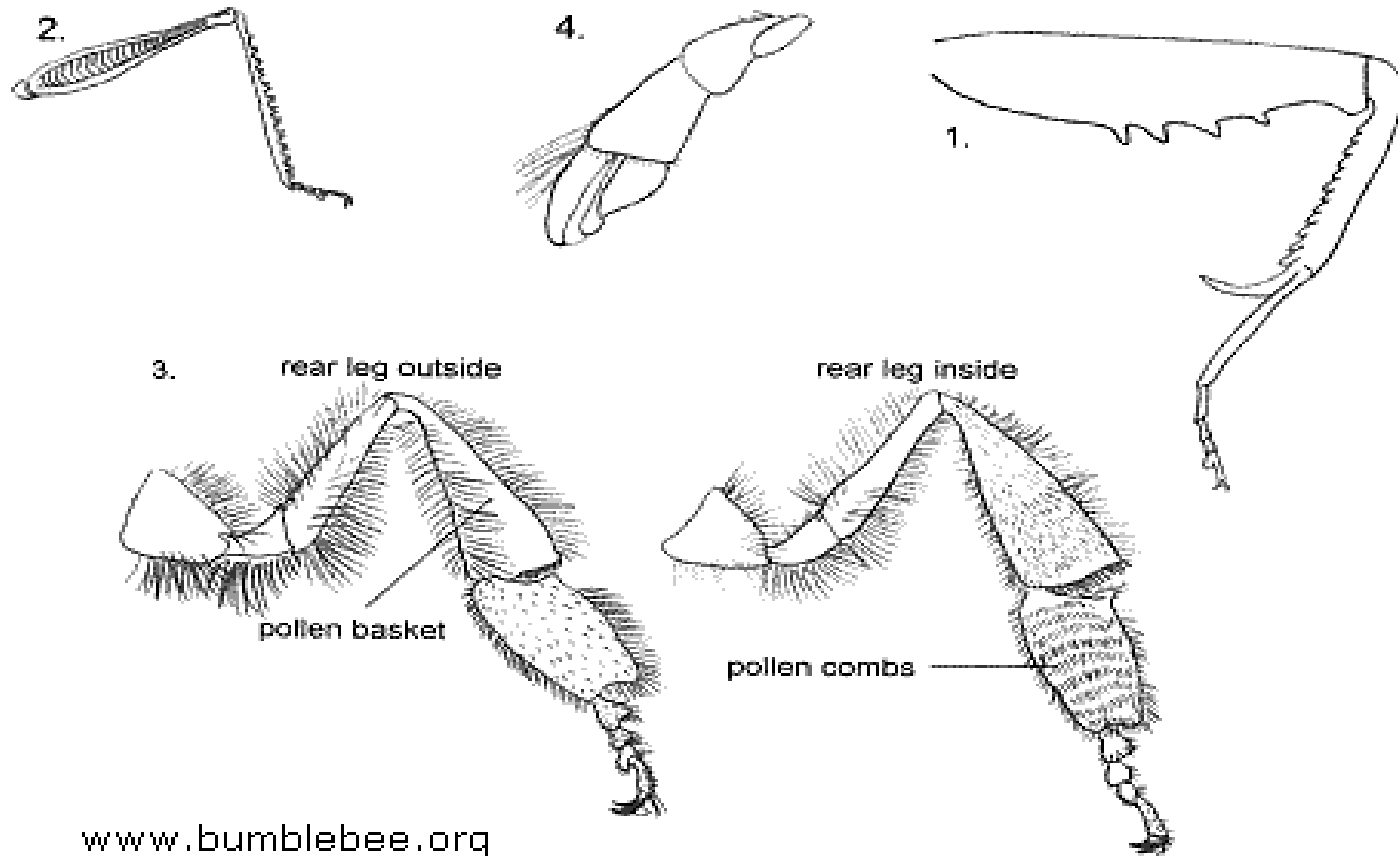


Legs

- The most important characteristic of an insect is the presence of 3 pairs of jointed legs
- Almost always present in adult form



Insect Legs (fig. 6-2)



Wings

(fig. 6-3)

- Venation (the arrangement of veins in wings) is different in different species
- Key in identification
- Name indicates the wing shape



Antennae

- Segmented
- Vary greatly in form and complexity
- Primarily organs of smell, often modified

Antennae

(fig. 6-4)



ARISTATE



LAMELLATE



SERRATE



FLABELLATE



MONILIFORM



SETACEOUS



GENICULATE



PLUMOSE



PECTINATE



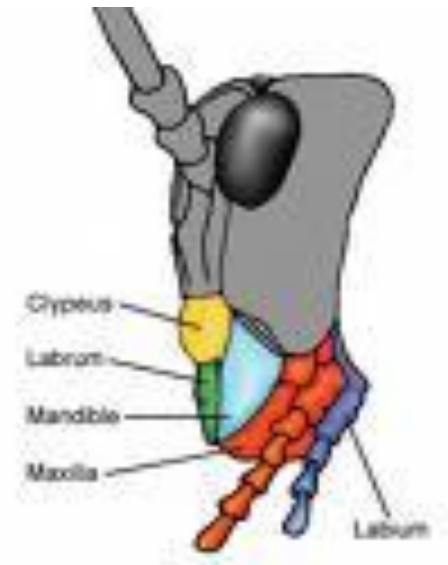
STYLATE



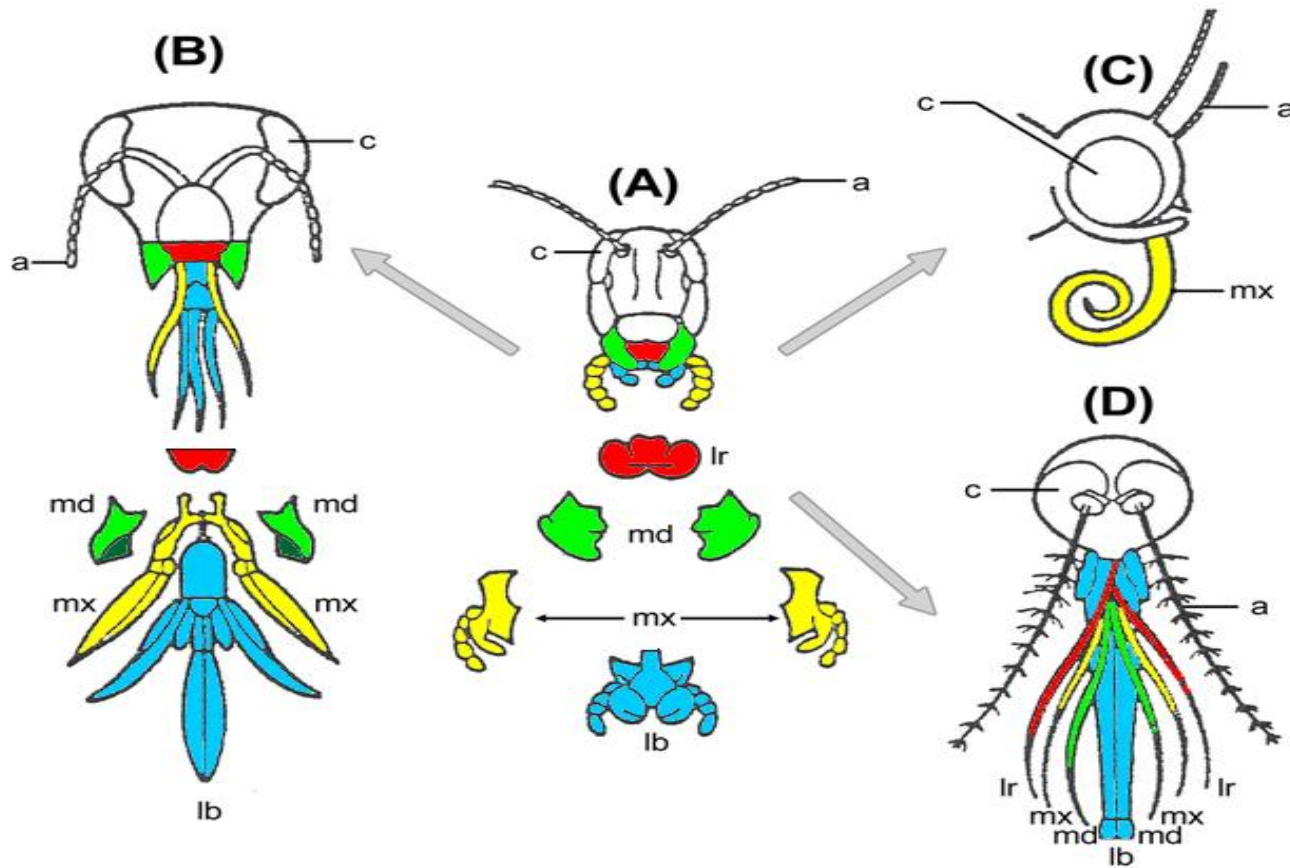
CLAVATE

Mouthparts (fig. 6-5)

- An insect's most complicated and remarkable feature is its mouth.
- Divided into 2 broad categories- chewing and sucking



Mouthparts



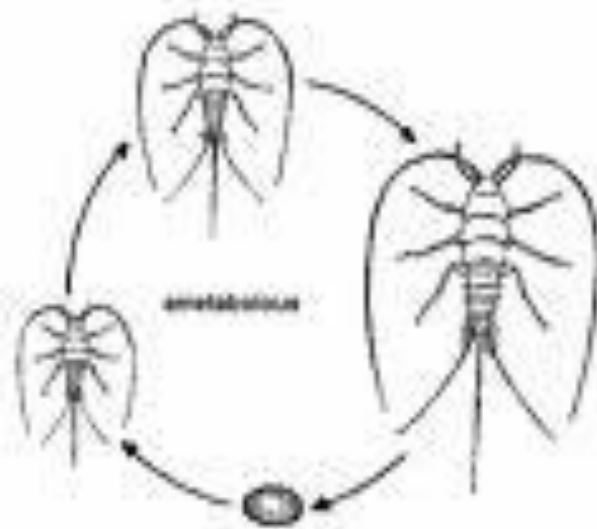
Insect Metamorphosis

(pg. 6)

- In humans, most of the important development takes before birth, in insects it occurs after birth or egg hatch.
- The immature period of an insect is primarily one of growth, feeding, and storing food for the pupal or adult stages that follow.
- Many insects feed very little during their adult life.

Insect Metamorphosis (Fig. 6)

- Some insects **do not go** through metamorphosis, but rather a gradual increase in size.
- Ex. silverfish



Insect Metamorphosis

Gradual

Metamorphosis

- Going through a nymph stage
- Egg-Nymph-Adult
- In some cases, union of egg and sperm, this is called **parthenogenesis**.
- Ex. Grasshopper

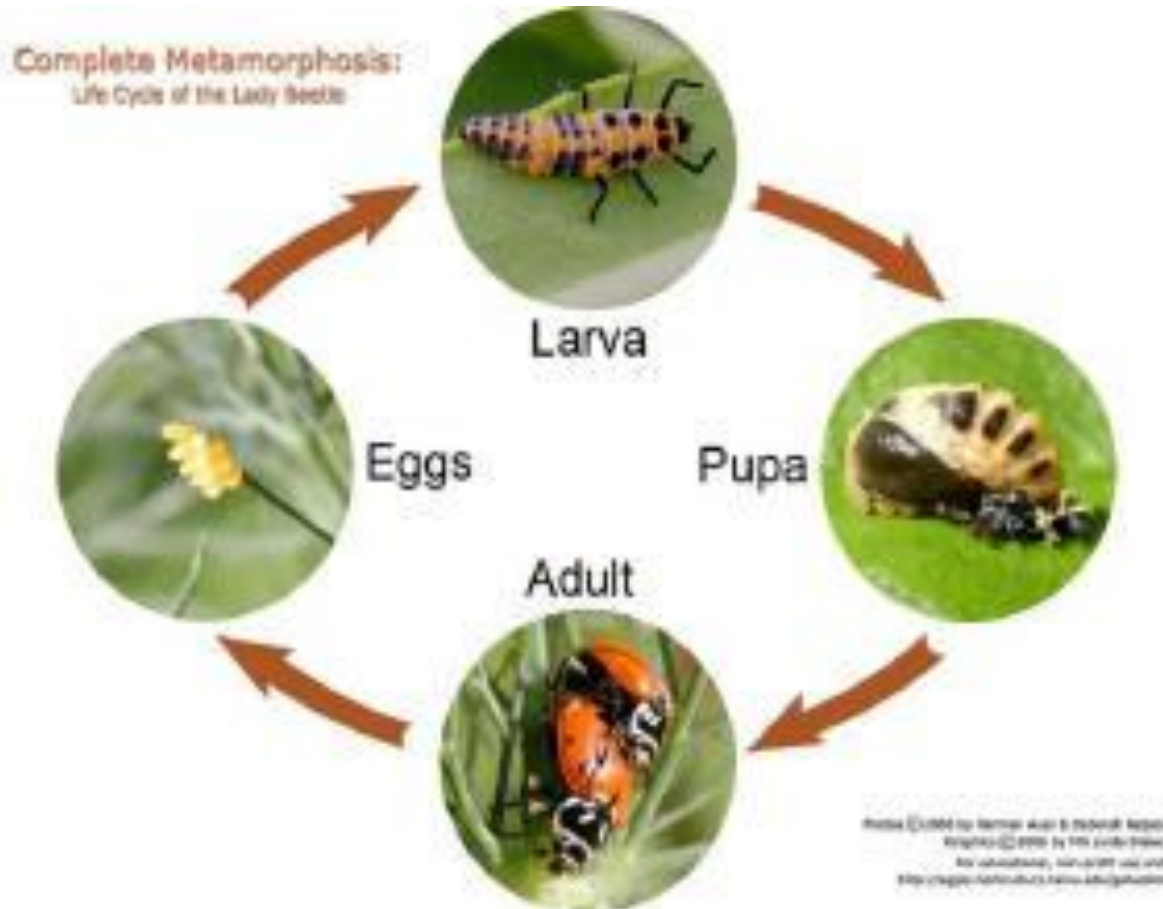


Incomplete Metamorphosis

- Much like gradual, but the immature form doesn't always resemble adult as in a dragonfly



Complete Metamorphosis



Complete Metamorphosis



Complete Metamorphosis

- Egg- Beginning stage deposited by the adult
- Larva- Usually worm-like that grows rapidly
- Pupa- period of profound change, transition to adulthood, tissues and structures are broken down and new ones form
- Adult- a period of reproduction, little or no growth, food is entirely different than during the larval stage

Identifying Insects

pg. 7

- Most of us home gardeners classify an insect by the common name, like beetle, wasp, butterfly and bee.
- The ability to classify an insect to the order level gives the gardener access to specific and valuable information
- Ex. Knowing info about mouthparts of an insect can tell us how it feeds and possible methods to control it

Specific Insect Orders

Insects are divided into 3 sections

1. Insects important to the gardener
2. Insects of lesser importance
3. Common “non-insect” period

Insect Orders

Important to the Gardener

Coleoptera- pg. 6

Ex. Beetles, Weevils

Adults

- hardened exoskeleton
- 2 pair wings, outer hardened inner
- Chewing mouthparts
- Prominent antenna

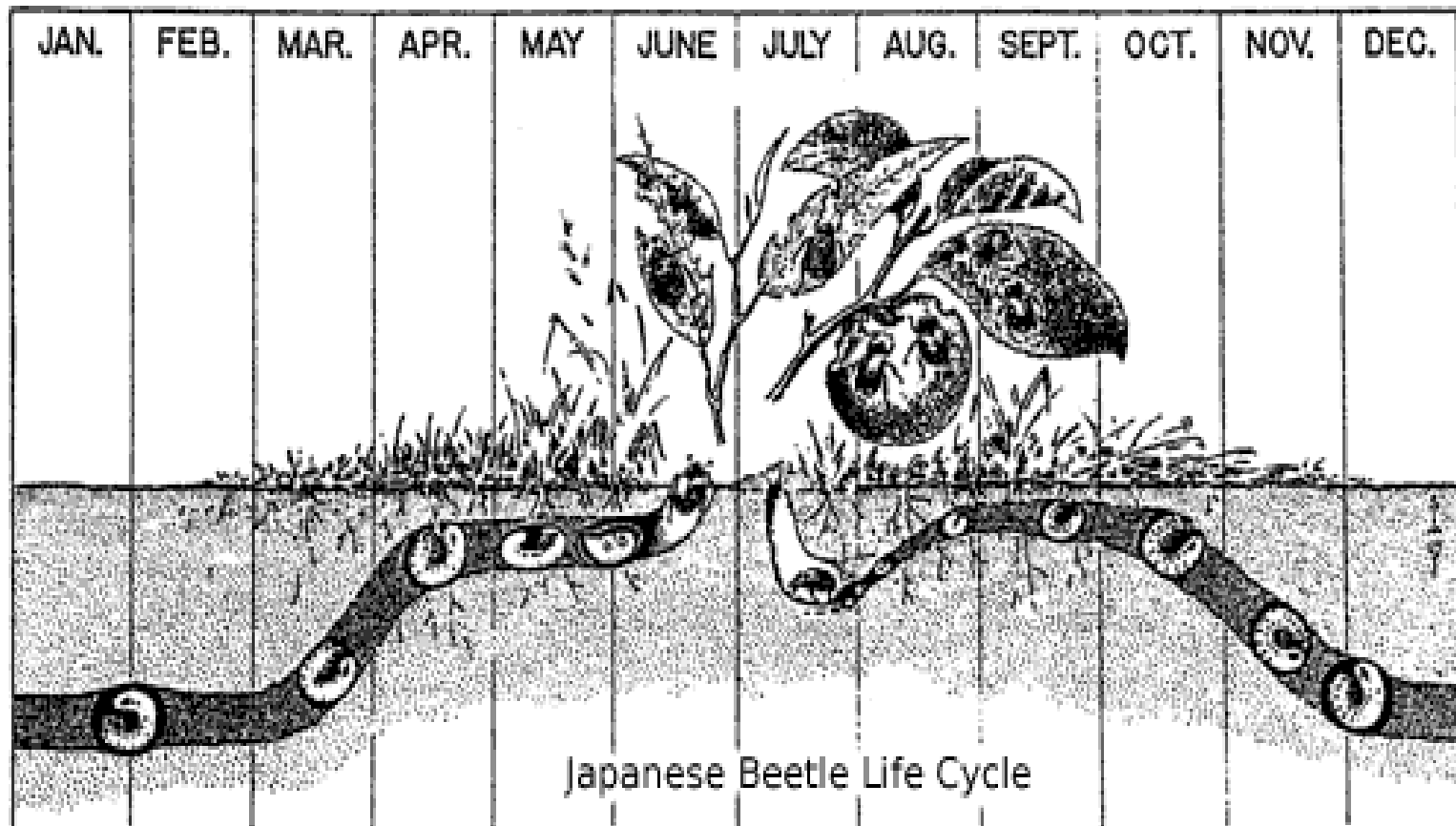


Order Coleoptera

(fig. 6-7)



Coleoptera Life Cycle



Order Dermaptera

(fig. 6-8)

Ex. Earwigs

- Moderate size adults
- Chewing mouthparts
- Modified abdomen pinchers that are like forceps
- Nymphs similar to adults



Order Diptera

(fig. 9)

Order Diptera

Ex. Flies, mosquitoes,
gnats, midges

Adults

- Only one pair of wings, soft, hairy
- Mouthparts sponging (fly) or Piercing (mosquito)
- Advanced larval forms, maggot, mosquito
- Complete metamorphosis



Order Hemiptera (Fig. 6-10)

Ex. Stinkbug, bedbug
boxelder beetle,
squash

- Grad.
Metamorphosis
- 2 pair wings
- Adults and nymphs
similar
- Piercing/sucking
mouth
- Adult and nymph
both damaging



Order Hemiptera



Order Homoptera

(fig. 6-11)

Ex. Scale insects, cicada, aphids, leafhoppers

- Both winged and unwinged forms
- All non-egg stages have sucking mouthparts
- Gradual metamorphosis
- Many are carriers of plant pathogens

Order Homoptera



Order Hymenoptera

(fig. 6-12)

Ex. Bees, mud dauber, wasp, ant

- Adults have 2 pair of membranous wings
- Larva have no legs or 3 pairs of legs on the abdomen
- Usually chewing mouthparts
- Complete metamorphosis

Order Hymenoptera



Order Lepidoptera

(fig. 6-13)

Ex. Butterflies, moths

- Soft bodied adults, well-developed wings
- Larva have chewing mouthparts, caterpillars are voracious eaters
- Adults have coiled, sucking mouthparts
- Complete metamorphosis

Order Lepidoptera



Order Neuroptera (fig. 6-14)

Ex. Lacewings,
dustywings

- Insect predators
- 2 pairs of
membranous wings
- Chewing mouthparts
- Complete
metamorphosis



Order Orthoptera

(fig. 6-14)

Ex. grasshopper, cricket, walkingstick, mantis, katydid

- Adults are large, hard-bodied
- Simple metamorphosis, egg-nymph-adult
- Adults have 2 pairs of wings, forewings are hardened, hind-wings are membrane
- Chewing mouthparts
- Immature species resemble wingless adults

Order Orthoptera



Order Thysanoptera (fig. 6-16)

Example- Thrips

- Small, soft bodied
- Mouthparts- piercing or sucking
- Varied metamorphosis
- Found on plants and flowers



Insects of Lesser Importance

pg. 11

See pg. 11

- These insects have little impact on gardeners

Common Non-Insect

Arachnida (fig.6-17)

Ex. Spider mites, spider, tick

- Small, soft-bodied with 2 body regions
- Many are beneficial predators
- Many spread disease
- Many are parasitic

Arachnids



Order Diplopoda (fig. 6-18)

Ex. Millipedes

- Elongated bodies
- 2 pairs of legs per segment
- Destructive to vegetables, feed on fungus and decaying plant



Order Chilopoda (fig. 6-19)

Ex. Centipedes

- Highly segmented
- 1 pair of legs per segment
- Beneficial predators
- Aggressive carnivores



Order Crustacea

(fig. 6-20)

Ex. Sowbugs, pillbugs

- Covered with hard, convex, outer shell, number of plates
- Highly dependent on moisture
- Feed on decaying wood and young plants



Types of Insect Injury

pg. 13 (fig. 6-21)

Chewing Insects

- Easy to see
- Defoliation
- Even small amount of damage can be devastating



Types of Insect Injury

pg. 13 (fig. 6-21)

Piercing-Sucking Insects

- Boring insects
- Often advanced before aware
- Symptoms include wilting, sap excretion, deformed fruit, spotting



Types of Insect Injury

pg. 13 (fig. 6-21)

Internal Feeders

- Lay eggs in plants, feed and cause destruction



Subterranean Insects

pg. 14

- Attack from below the surface
- Interfere with root development and cause root decay

Ex. corn rootworm



Laying Eggs

- Many species lay eggs in root systems and young wood
- Eggs impede growth and use nutrients
- Galls form and destroy shoots



Use of Plants for Nests

- Use plant material to build nests

Ex. Leaf cutter ants
and bees



Insect-Vectored Diseases

pg. 14

Insects may spread disease in the following ways:

- Feeding, laying eggs, or boring into plants, creating entrance points for disease
- Carry disease on their body and inject it as they feed
- Emit caustic agents that cause damage
- Host in a pathogen's life-cycle

Beneficial Insects

pg. 16

Benefit gardener by:

- Aid in production of food- pollination
- Destroy competitors of beneficial plants
- Improve physical conditions in the soil
- Scavengers

Minimizing Chemical Control

pg. 16

- Soil preparation
- Plant selection
- Rotating crops
- Inter-planting
- Thinning
- Watering
- Timing planting
- Sanitation
- Staking
- Injury prevention
- Mulching
- Controlling weeds

Mechanical Controls

- Handpicking- look for egg clusters, worms and beetles
- Traps
- Barriers-aluminum foil, plastic
- Exclusion- covers, cheesecloth, etc.

Biological Controls

- Predators, parasites, and pathogens
- Natural predators

Ex. preying mantis, ladybugs, lacewings and ground beetles



Nonsynthetic Pesticides

- Botanicals
- Soaps
- Home remedies

Synthetic Pesticides

- See attached